
Electric Vehicle Field Operations Program



Fleet Evaluation Procedures

for the

U.S. DEPARTMENT OF ENERGY

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ELECTRIC TRANSPORTATION DIVISION



An EDISON INTERNATIONAL Company

Electric Vehicle Field Operations Program

Fleet Evaluation Procedures

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Abbreviations

ABB - Asea Brown Boveri

AC - Alternating Current

A/C - Air Conditioning

ATA - American Trucking Associations

BMI - Basic Measuring Instrument

CFD - Corporate Fleet Department

DC - Direct Current

DOE - U.S. Department of Energy

EPA - Environmental Protection Agency

ETA - Electric Transportation Application

EV - Electric Vehicle

FMS - Fleet Management System

fps - Speed in feet per second

fps² - Acceleration in feet per second squared

fwy - Freeway

g - Acceleration of gravity in fps²

hrs. - Hours

ICE - Internal Combustion Engine

INEEL - Idaho National Engineering and Environmental Laboratory

IWC - Infrastructure Working Council

kW - Kilowatt

kWh - Kilowatt hour

lb. - Pounds force

mi - Miles

mph - Miles per hour

MPR - Miles per charge

MTBF - Mean Time Before Failure

MTTR - Mean Time to Repair

OEM - Original Equipment Manufacturer

RT - Recharge time

SAE - Society of Automotive Engineers, Inc.

SCE - Southern California Edison Company

sec - Second

soc - State of charge

TSD - SCE's Transportation Services Department

TOU - Time of Use

VE - Vehicle efficiency

VIS - Vehicle Information System

Wh - Watt-hours

Electric Vehicle Field Operations Program

Fleet Evaluation Procedures

1.0 Introduction

1.1 Background

These Fleet Evaluation Procedures were prepared to ensure consistent and accurate documentation of the performance, reliability and cost of operating, commercially viable and EV America accepted electric vehicles (EVs) placed in fleet use throughout the United States. EV America accepted EVs are defined as, EVs that have met the minimum vehicle requirements as defined in the “1997 EV America Technical Specification.”

1.2 Objectives

The objective of these procedures is to collect comparative fleet data from all of the fleet operators across the United States. To accomplish this objective, the following are presented:

- The type of data that must be collected by each participant
- Optional techniques for gathering the data
- Examples of how the data must be displayed
- The content of the quarterly report to DOE

1.3 Scope

The following procedures are an adjunct to the Fleet Evaluation Guide. The Guide should be consulted for methodologies, ideas and techniques that have been used by EV fleet operators to match user needs to EV capabilities, and document their performance.

1.4 Arrangement of the Procedures

The procedures have been arranged into the following three groups:

- I Operation - SCE - OP XX
- II Maintenance - SCE - MA XX
- III Ownership - SCE - OW XX

The procedure titles, source of the data used for conducting the procedures, and procedure number can be found in Figure 1.4-1.

Figure 1.4-1

**DOE FIELD OPERATIONS PROGRAM
FLEET EVALUATION GUIDE/PROCEDURES
DATA/INFORMATION DEFINITION**

TYPE OF QUESTION

ISSUES/ANSWERS NEEDED	WHAT	HOW	WHEN	WHERE	HOW LONG	HOW MANY	HOW MUCH (\$)	DATA/INFO. SOURCES	PROCEDURE NUMBER	GUIDE REF-PARAGRAPH
I / OPERATION										
• Mission Selection/Characterization	×			×				Questionnaire/Debriefing	SCE - OP 01	5.1, 5.2, 5.3
• Vehicle Selection/Acceptance	×	×						Questionnaire/Debriefing	SCE - OP 02	2.0, 3.1, 4.3, 5.4
• Infrastructure Implementation	×	×		×		×	×	Questionnaire/Debriefing/Acctg. Rec.	SCE - OP 03	4.0
• Vehicle Substitution/Commissioning		×						Questionnaire/Debriefing	SCE - OP 04	5.1, 5.2, 5.6
• Driver Training		×						Questionnaire/Debriefing	SCE - OP 05	5.5
*• Miles/Month & Miles/Charge						×		Odometer/kWh Meter	SCE - OP 06	4.2.1, 7.0
• Charging Patterns/Times			×		×			kWh Meter	SCE - OP 07	4.2.1, 7.0
• Charging Energy (KWh)						×	**	kWh Meter	SCE - OP 07	4.2.1, 7.0
*• Efficiency (Miles/AC KWh)						×		Odometer/Meter	SCE - OP 08	4.2.1, 7.0
*• Driver's Response		×						Questionnaire/Debriefing	SCE - OP 09	4.3.4
II / MAINTENANCE										
• Technician Training	×	×			×			Questionnaire/Debriefing	SCE - MA 01	6.0
• New Equipment Needed	×						×	Questionnaire/Debriefing/Acctg. Rec.	SCE - MA 02	4.2.1, 4.2.2
• New Facilities Needed	×			×			×	Questionnaire/Debriefing	SCE - MA 03	4.1, .4.2
• Parts Inventory	×			×		×	×	Tracking System/Accounting Records	SCE - MA 04	4.2.1, 4.2.2
• Maintenance Labor (Hrs)						×	**	Tracking System/Accounting Records	SCE - MA 05	4.2.1, 4.2.2, 7.0
*• Vehicle Availability/Downtimes (% - Days)			×		×	×		Tracking System/Accounting Records	SCE - MA 06	4.2.1, 4.2.2, 7.0
*• Quit-on-Road (QOR) Incidents		×				×		Tracking System	SCE - MA 07	----
• Vehicle System Reliability (MTBF, MTTR)	×					×		Tracking System/Accounting Records	SCE - MA 08	4.2.1, 7.0
• Operating Costs							×	Tracking System/Accounting Records	SCE - MA 09	8.0
III / OWNERSHIP										
• Vehicle Acquisition		×					×	Accounting Records	SCE - OW 01	9.1
• Vehicle License/Insurance							×	Accounting Records	SCE - OW 02	9.2, 9.3
• Safety Training	×	×					×	Questionnaire/Debriefing	SCE - OW 03	5.5, 6.0
• Emergency Preparedness	×	×		×			×	Questionnaire/Debriefing	SCE - OW 04	5.5, 6.0
• Battery Decommissioning		×					×	Accounting Records	SCE - OW 05	9.7
• Vehicle Decommissioning		×					×	Accounting Records	SCE - OW 06	9.6
• Ownership Costs							×	Accounting Records	SCE - OW 07	9.0
• Total Costs							×	Tracking System/Accounting Records	SCE - OW 08	10.0

* Minimum data from all EV's in fleets nationwide.

** Fleets to apply specific rates.

Fleet Evaluation Procedure SCE-OP 01

Mission Selection/Characterization

1.0 Introduction

Both missions and vehicles must be matched for the successful integration of EVs into an automotive fleet. In general, suitable missions have limited and predictable driving distances, with known maximum payloads, on relatively level terrain. Suitable vehicles will meet or exceed the mission requirements.

2.0 Procedure

For each mission being considered at a given site, the user shall be interviewed to determine the mission requirements and the first column on Form SCE-OP1-1 completed. The second column shall contain a “Yes” or “No” to indicate if the requirement is mandatory or not (e.g. air conditioning, heater, etc.). The vehicle characteristics, in the third column, shall be obtained from the EV America Performance Statistics, for the candidate EV, and added to the form. The fourth column is a comparison of the vehicle characteristics to the mandatory requirements. If the candidate EV fails to meet or exceed a single mandatory requirement, a different EV or mission must be selected. The mission importance column is the relative worth of the attribute in comparison to all other attributes. The mission fit column is the evaluator’s assessment to what degree the vehicle meets the mission requirements (1 - The requirement is barely met, 5 - It is far exceeded). The rating value is the mission importance times the mission fit for each attribute listed. The values in the last column shall be added together and the sum entered on the mission total line. The mission total for various options can be compared and the mission/vehicle with the largest total is the best of the evaluated options.

It should be noted that it is preferable to have all sites evaluated by the same person so the bias between a high or low evaluator will be eliminated.

Mission and Vehicle Matching Evaluation Form

Participant _____

Mission Description: _____

Vehicle Description: _____

DOE/EV America baseline performance fact sheets are used to determine vehicle characteristics

Attribute	Mission Requirement	Mandatory Requirement	Vehicle Characteristics	Pass Mandatory? ☆	Mission Importance (1 low – 5 high)	Mission Fit (1 low – 5 strong)	Rating Value (Importance x Fit)
Max Range (miles) ¹							
Max Speed (mph) ²							
Max Grade (%)							
Acceleration (seconds) ³							
Payload (pounds)							
Passengers							
All Wheel Drive							
Air Conditioning							
Heater							
Noise							
Emissions							
Public Relations							
Operator Enthusiasm							
					Mission Total		

☆ If a vehicle fails to meet a single mandatory requirement, it is considered incapable for meeting all of the mission requirements.

Evaluator's Name: _____

Date: _____

¹ Vehicle value – SAEJ1634

² Vehicle speed at 50% State-of-charge

³ Acceleration at 50% State-of-charge

Fleet Evaluation Procedure SCE-OP 02

Vehicle Selection/Acceptance

1.0 Introduction

Most OEM produced electric vehicles will have adequate performance, except range, to fulfill most light duty transportation requirements. Therefore, the range capability of a candidate EV must be carefully considered when selecting a vehicle for a specific mission.

2.0 Procedure

2.1 Vehicle Selection

It is assumed that the EV America Performance Statistics and Vehicle Specifications will be available before a vehicle is selected for fleet evaluation. Therefore, that information must be compared to information collected on the Mission and Site Evaluation Form (SCE-OP 01-1) to verify that the EV will meet or exceed the mission requirements. Because the standard tests can not accurately predict the range for a unique mission, a vehicle should be selected whose range exceeds the requirements by at least 20%.

2.2 Vehicle Acceptance

Upon receipt, the vehicle shall be inspected for damage and pertinent data recorded on the Vehicle Turn-key and Acceptance Log (SCE-OP 2-1). Information from the log shall be entered into the Fleet Management System and EV Fleet Database. Prior to placing the vehicle in service, it should be “characterized.” At a minimum, the range from a 100% SOC to a 20% SOC shall be measured on a closed circuit. This will allow a similar test to be performed at a later date so the battery

performance as a function of time/use can be quantified.

After the vehicle is accepted, pertinent information from the EV America Specifications and SCE-OP 2-1 Form shall be entered into the EV Fleet Data Base.

2.3 Data Collection

A copy of Form SCE-OP-2-1 shall be provided to Idaho National Engineering and Environmental Laboratory (INEEL) after all corrections are complete in hard copy, Excel spreadsheet, or ASCII format in column order: site, vehicle id, year, manufacturer, model, VIN, Battery Type, Battery Manufacturer, Battery Model and Number of modules.

All data provided to the INEEL can be e-mailed to pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID, 83415-3730. The data can be on 3.5 inch diskettes, zip drive or cd-rom. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

VEHICLE TURN KEY AND ACCEPTANCE DATA LOG

Participant _____

Page ____ of ____

Vehicle No. _____

Inspection Hours _____

CAB/CHASSIS DATA

Year _____ Manufacturer _____ Model _____

V.I.N. _____ Odometer _____ P.O. _____

WINDOW STICKER

Range: _____ City _____ Hwy _____ Efficiency _____ AC kWh/Miles

BATTERY DATA

Type _____ Manufacturer _____ Model _____ No. Modules _____

Pack/Voltage _____ Pack Capacity (DC kWh) _____ Pack Weight (lbs) _____

INSPECTION

Miles _____

Inspector _____

Characterization _____

Contact Inspector at _____

Item	Corrections	Date	Complete	
			Yes	No

Vehicle Completion Date _____

FMS Data Entry Complete _____

Fleet Evaluation Procedure SCE-OP 03

Facilities Infrastructure Implementation

1.0 Introduction

The facilities infrastructure required to support EVs is unique and could be time consuming to implement. Therefore, the requirements must be addressed early in the planning process to insure the infrastructure is operational before the EVs arrive.

This procedure addresses only those items associated with EV charging and parking. The maintenance infrastructure requirements are addressed in subsequent procedures.

2.0 Procedure

To accurately assess the facilities infrastructure requirements and costs, the Charger/Site Assessment Worksheet (SCE-OP 3-1) shall be completed if the modifications are extensive. If various sites are being considered, the cost information on the form will be an important consideration in the site selection process.

If the facilities modifications are not extensive, the worksheet is not required.

After an off-board charger is installed, the "Off-Board Charging Facilities Inventory" form (SCE-OP 03-2) shall be sent to the INEEL at e-mail address pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID 83415-3730. All questions can be directed to Patti McGuire at 208-526-6787. Each inventory form submitted must contain the total inventory of the participant's chargers and EVs.

Charger/Site Assessment Worksheet

Participant _____

Customer Name/Address/Phone Number:

Charger Installation on Electrical Facilities (customers)

Existing

New

- Panel Size / Capacity (amps)

- * Main Panel

- * Sub Panel

- * Design, Hardware and Installation Costs

\$_____

\$_____

Vehicle Recharge Capacity (amps)

- * Cars/Trucks (____ kW charger)

- * Buses (____ kW charger)

- * Design, Charger and Installation Costs

\$_____

\$_____

- * ABB Meter and Installation Costs

\$_____

\$_____

Utility Service (overhead or underground)

- Service Voltage

- Transformer

- * Size

- * % Loaded (pre-EV)

- * Design, Hardware and Installation Costs

\$_____

\$_____

- Service Conductor

- * Size

- * Capacity

- * Design, Hardware and Installation Costs

\$_____

\$_____

- Number of Vehicles Capable of Serving

- * Cars/Trucks (____ kW charger)

- * Buses (____ kW charger)

- Total Equip. or Upgrade Cost to Utility

\$_____

\$_____

- Total Equip. or Upgrade Cost to Customer

\$_____

\$_____

Charger/Site Assessment Worksheet (continued)

Facilities

Existing

New

- Customer Costs
 - * Facility Modification Costs - Design and Installation of Parking/Charging Spaces, Roof, Fence, Etc.
 - * Per Vehicle
- Utility Costs in Addition to Those Above
 - * Facility Modification Costs - Design and Installation
 - * Per Vehicle
- Total Infrastructure Cost

\$_____ \$_____

\$_____ \$_____

\$_____ \$_____

Load Management

- Operating Hours
- Seasonal Loads (yes/no)
- Load Management Device (Yes/No)
 - * Type (TOU Rate, Timer, etc.)
- Will Load Management Devices Reduce EV Operating Costs (Yes/No)

Prepared by: _____

Date: _____

Off-Board Charging Facilities Inventory

Participant _____

Charger Location Address:

Chargers:

Type	Wall	Box	Level 3	Inductive
Number				
Mfgr				
Mfgr				
Mfgr				
EVs Charged By				

Charger Location Address:

Chargers:

Type	Wall	Box	Level 3	Inductive
Number				
Mfgr				
Mfgr				
Mfgr				
EVs Charged By				

Prepared By: _____

Date: _____

Fleet Evaluation Procedure SCE-OP 04

Vehicle Substitution/Commissioning

1.0 Introduction

To help ensure success, it is important to have the using and maintenance organizations become part of the program. This can be accomplished by personal contacts, soliciting their comments, rapid correction of deficiencies, returning a repaired vehicle to service quickly and, if this can't be done, having a loaner vehicle available.

2.0 Procedure

To assist in integrating vehicles into the fleet, the Vehicle Substitution/Commissioning Checklist (SCE-OP 04-1) shall be utilized. The checklist will help insure that important items are not overlooked.

3.0 Data Collection

A copy of Form SCE-OP-04-1 shall be sent to the INEEL when a vehicle is placed in service, removed from service or the mission is changed.

All data provided to the INEEL can be e-mailed to pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID, 83415-3730. The data can be on 3.5 inch diskettes, zip drive or cd-rom. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

VEHICLE SUBSTITUTION / COMMISSIONING CHECK LIST

Participant _____

Vehicle Information:

Make _____ Model _____ Year _____ VIN _____

Mission Description:

Contact Name:

Address/Vehicle Charging Location:

Phone Number: _____ Fax Number: _____

Coordination:

1. User Notified of Delivery
 - a. Message Left: Date
 - b. Contact Made: Date
2. Maintenance Notified of Delivery
 - a. Yes: Date
 - b. EV Available: Date
3. Charging Station Installed
 - a. Yes: Date
4. ABB Meter Installed
 - a. Yes: Date
 - b. Meter No.:

Pre-Delivery:

1. Operational Information Mailed
 - a. Yes: Date
 - b. No
2. Log Book, Emergency Procedures and Operator's Manual in Vehicle
 - a. Yes: Date
 - b. No

Delivery:

1. Truck Ordered
 - a. Yes: Date

Training:

1. Date and Time
2. Driver's Name(s):

IN-SERVICE INFORMATION IN EV DATABASE

1. Date of return
2. Odometer reading
3. Ending kWh meter reading

END OF SERVICE INFORMATION IN EV DATABASE

1. Date of return
2. Odometer reading
3. Ending kWh meter reading

Coordinator: _____

Phone Number: _____

Date: _____

Fleet Evaluation Procedure SCE-OP 05

Driver Training

1.0 Introduction

Driver training is important for the safe and efficient operation of the EV. It will also provide the “tools” so the driver can achieve the full operating potential of the EV.

Driver Training

All potential drivers of the EV, including maintenance personnel, shall receive driver training. The training must take place at the vehicle, so the location of the following can be pointed out and described:

1. Major drive components - motor, controller, battery pack, auxiliary battery, transmission, etc.
2. Data acquisition system - if so equipped
3. EV Daily Record (SCE-OP 06-1) - if a data acquisition system is not used
4. Emergency Procedures - includes the name of the person to contact with telephone number plus safety precautions, e.g. the driver shall be instructed not to attempt to repair the EV
5. Charger cord and receptacle
6. Controls

The training shall include:

- A handout that shows the vehicle performance, capacity, and range as a function of payload, speed and accessory use. The handout shall be discussed, so the driver won't attempt to exceed the capabilities of the vehicle. This information may be presented in graphical format (See SCE-OP 05-1) or in tabular form.

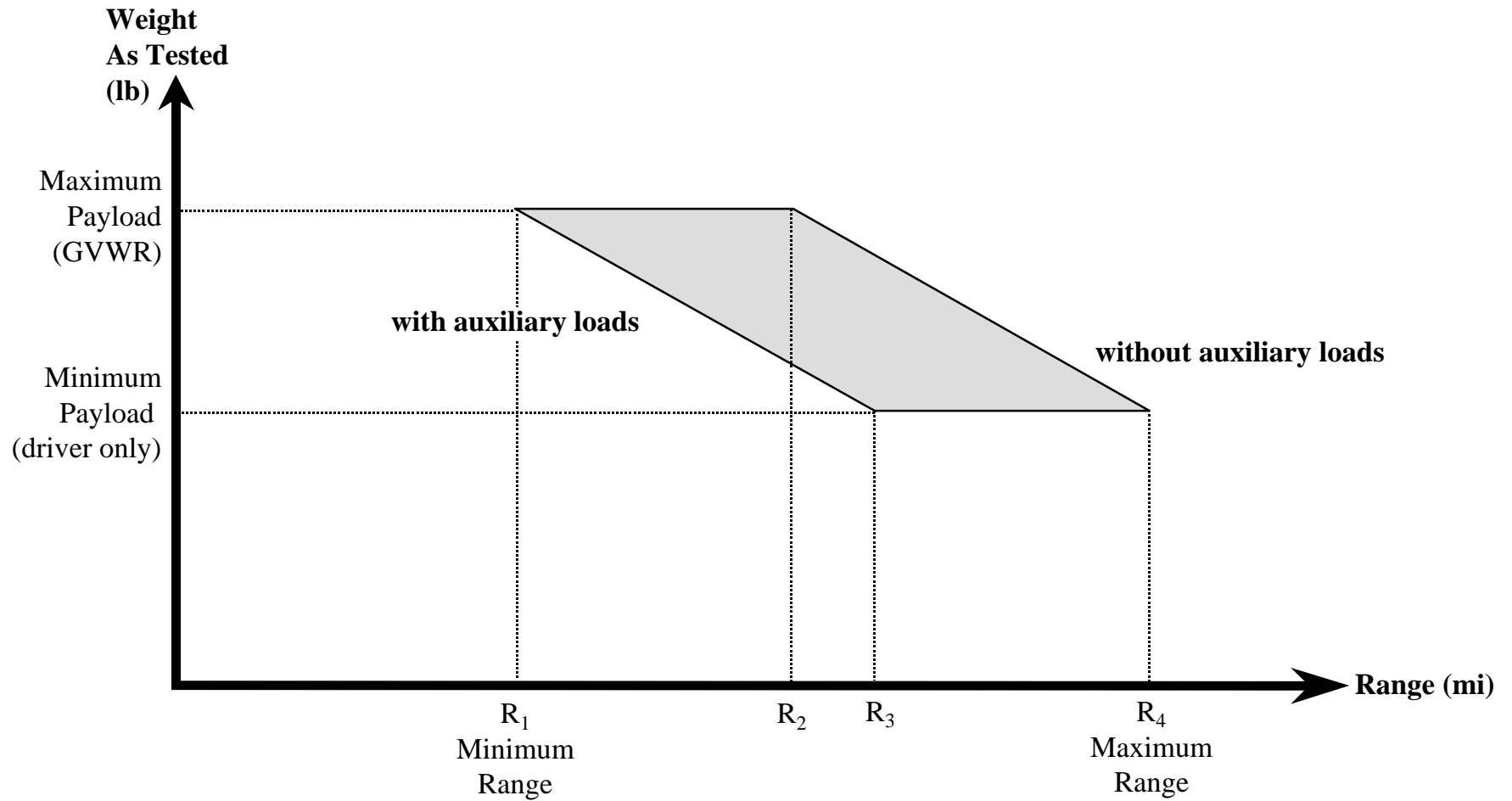
- Driving tips to maximize performance and range.
- A discussion about the features that are unique to EVs, e.g., dynamic braking, noise, creep, etc.

After becoming familiar with the controls, each driver shall receive “hands on training.” The training shall entail: filling in the Daily Log (if required), unplugging and stowing the charger cord, driving the vehicle with an instructor, returning the EV to the charger location, filling in the log and placing the vehicle on charge.

A training log shall be maintained that includes the driver’s name, organization, date of training, and vehicle make and model on which the driver was successfully trained. The driver should receive a wallet sized card in recognition of their proficiency in operating a specific EV.

Figure SCE-OP 05-1

EV Range Envelope



Fleet Evaluation Procedure SCE-OP 06

Miles/Month, Miles/Charge

1.0 Introduction

It is essential to record the mileage data for calculating the operating and ownership costs/mile. The two costs have a common denominator, so they can be added together to arrive at the total cost of operating an EV. Also, the mileage is used in calculating vehicle efficiency (miles/kWh). Both of the costs and efficiency will be addressed in subsequent procedures.

2.0 Procedure

The mileage data may be read monthly, or an on-board mileage recorder such as the Silent Witness may be used to gather the mileage data. The data shall be entered into the EV Fleet Database so the subject calculations can be performed. The mileage data must be correlated with the ABB meter data so the miles/each charge can be calculated accurately. To improve the accuracy of the calculations, it is preferred that the miles/day and miles/charge be entered into the EV Fleet Database.

At a minimum, the miles/month and charge events/month (see SCE-OP 07) shall be entered into the EV Fleet Database.

The data shall be displayed in the formats indicated in Figures SCE-OP 06-1 through -5.

3.0 Data Collection

Mileage readings shall be provided to the INEEL in hard copy, Excel spreadsheet or ASCII format in column order: vehicle id, reading date, odometer. Mileage can be read on a monthly basis.

All data provided to the INEEL can be e-mailed to pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID, 83415-3730. The data can be on 3.5 inch diskettes, zip drive or cd-rom. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

4.0 Data Processing at INEEL:

From the mileage readings and ABB meter data (see SCE-OP 07), the following are calculated:

- average miles/charge by vehicle model
- miles/charge by vehicle model

FIGURE SCE-OP 06-1

TOTAL MILEAGE BY VEHICLE MODEL

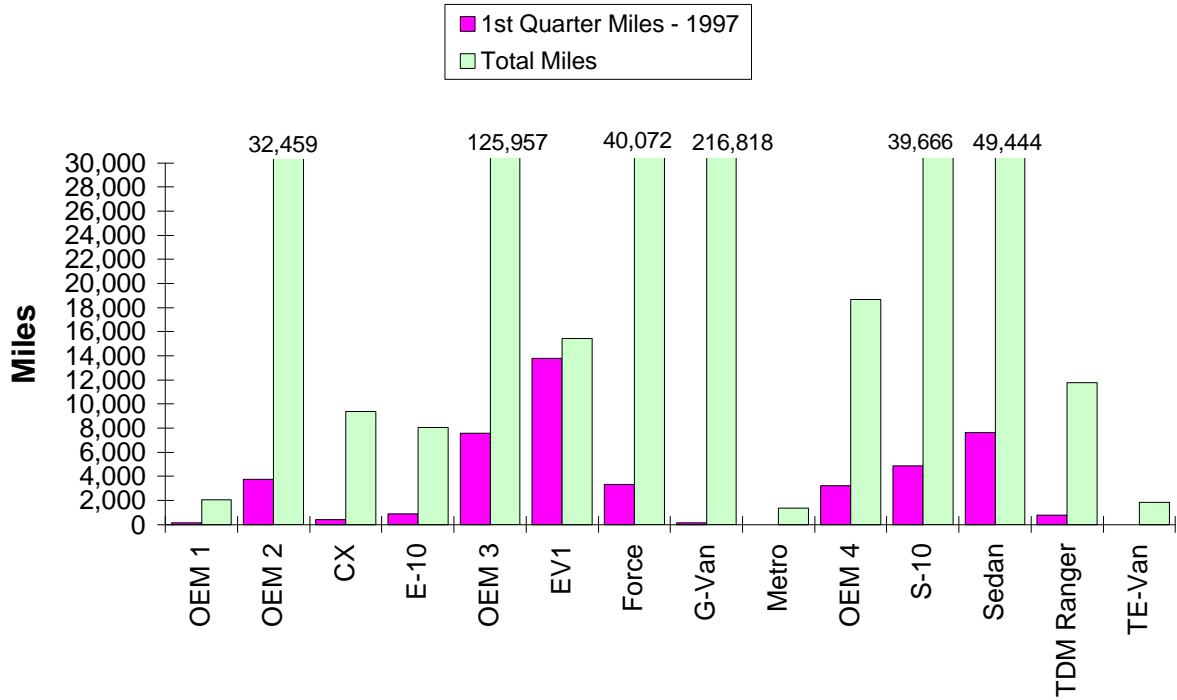


FIGURE SCE-OP 06-2

CUMULATIVE FLEET MILEAGE

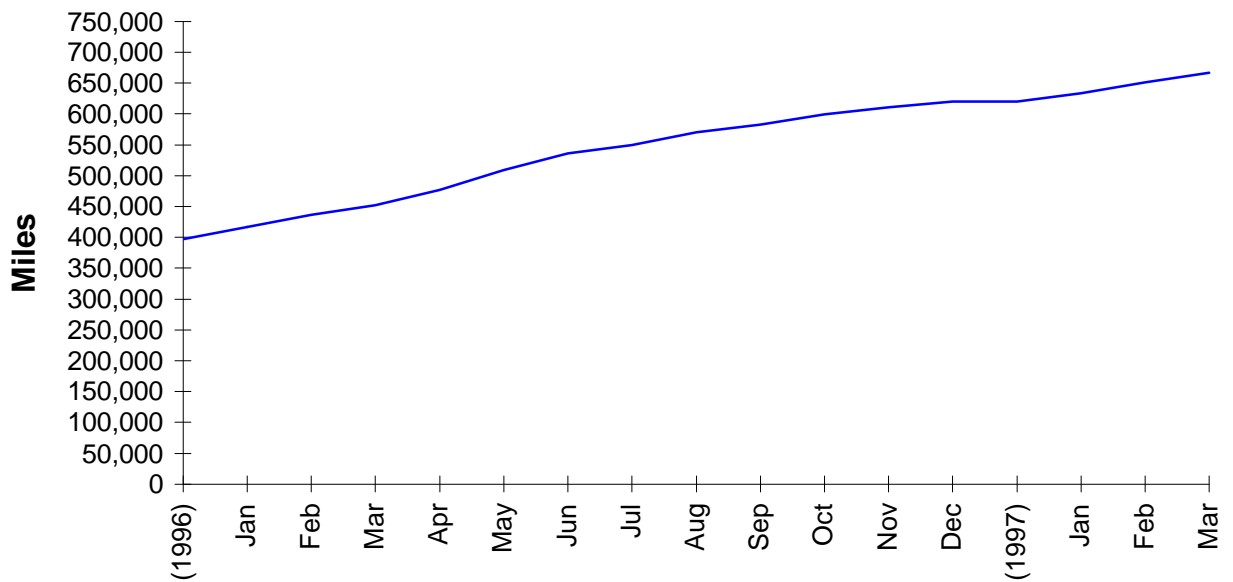


FIGURE SCE-OP 06-3

SLIDING TWELVE MONTH FLEET MILEAGE

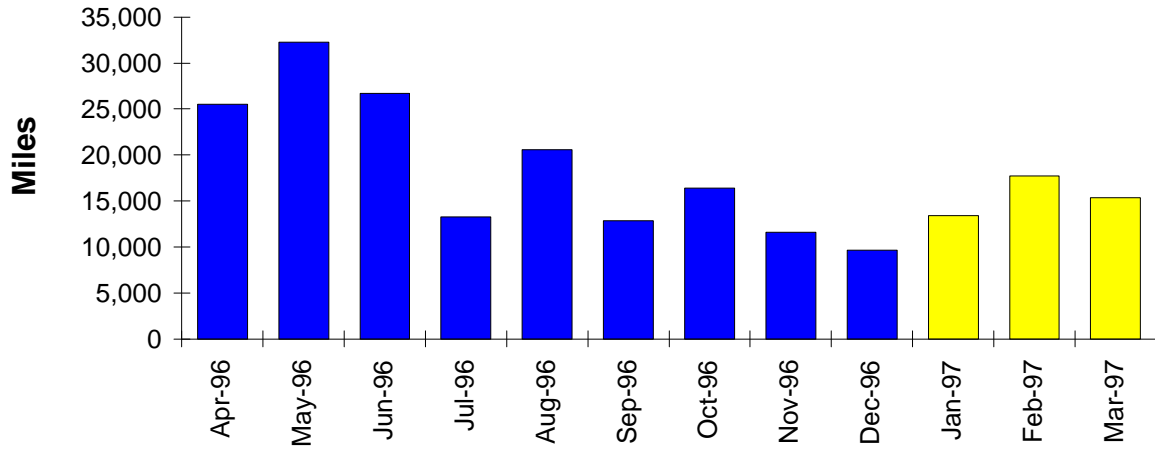


FIGURE SCE-OP 06-4

AVERAGE MILES/CHARGE BY VEHICLE MODEL

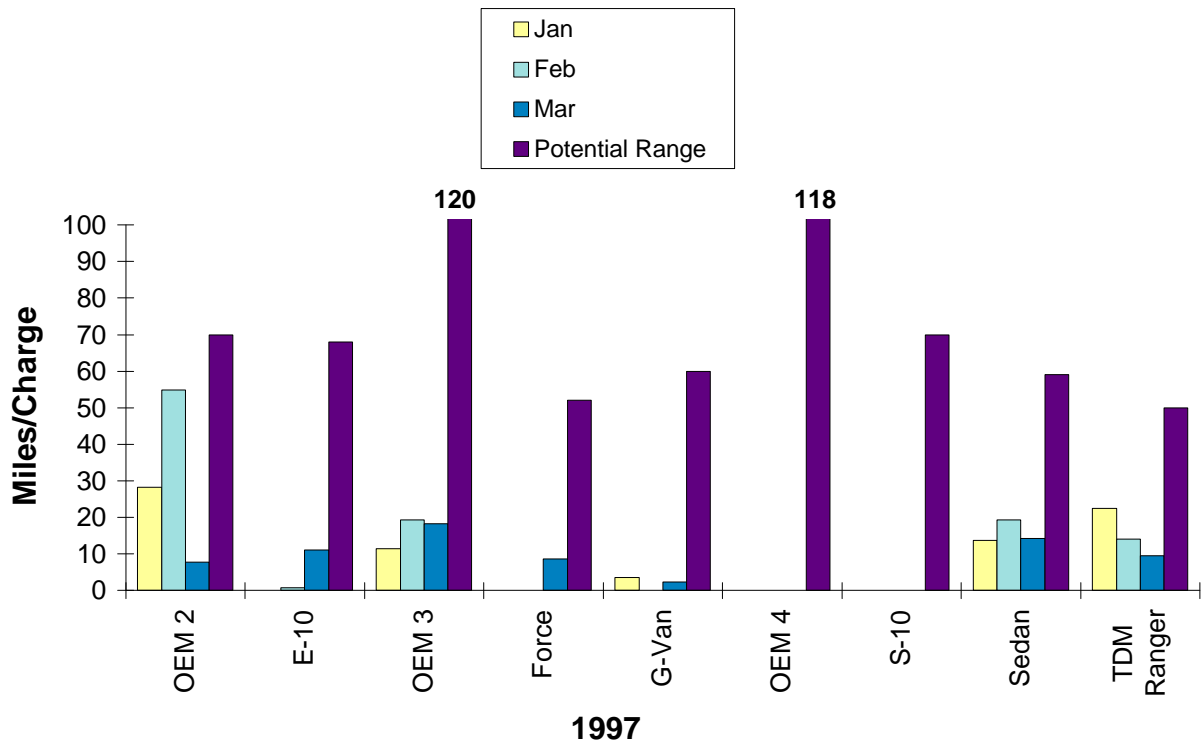
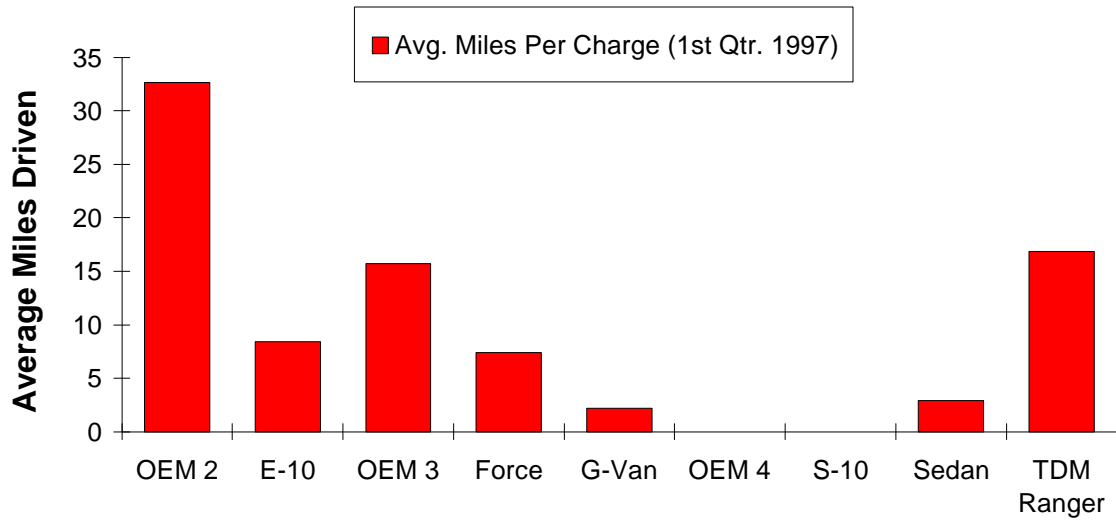


FIGURE SCE-OP 06-5

MILES PER CHARGE BY VEHICLE MODEL



Fleet Evaluation Procedure SCE-OP 07

Charging Energy, Events and Patterns

1.0 Introduction

The amount of energy used by the EV, to drive the distance recorded by Procedure SCE-OP 06, is required to calculate EV efficiency (miles/AC kWh). The number of charging events along with the miles traveled is used to calculate the miles/charge.

The charging pattern indicates: when the vehicle is charged (time of day), duration of the charge (hours), and the magnitude of the charge (kWh). It also allows assessment of the EV's impact of the utility system. If time-of-use (TOU) rates are available, the charging pattern provides the information required to accurately calculate the cost of the energy consumed.

2.0 Procedure

An ABB recording kWh meter shall be installed at the EV charging location or in the vehicle if the EV does not have a dedicated charging location. The ABB meter is described in Appendix B1 in the Fleet Evaluation Guide and its installation instructions can be found in Appendix D1. It should be noted that a laptop computer with ABB meter software are required to retrieve and display the data from the meter. The data from the meter shall be entered into the EV Fleet Database for use in generating the monthly and quarterly reports. The information for the reports shall be in the formats indicated in Figures SCE-OP 07-1 and -2.

3.0 Data Collection

Charging data shall be provided to the INEEL in ABB meter raw data

format or ASCII format. ASCII format should provide the vehicle id, the date/time stamp (to the nearest 15 minutes), and the energy charged.

All data provided to the INEEL can be e-mailed to pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID, 83415-3730. The data can be on 3.5 inch diskettes, zip drive or cd-rom. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

4.0 Data Processing at INEEL:

From the mileage readings and ABB meter data (see SCE-OP 06), the following are calculated:

- number of charges per month
- miles per charge (see Figure SCE-OP 06-5)
- average charge time
- energy charged at on-peak rates
- energy charged at off-peak rates

The ABB raw data are converted to ASCII files using the EMFPLUS software. The data is converted into pulses. The energy data (Wh) is then loaded into an ORACLE database on an hourly, daily, and monthly basis. These three formats are used for ease of retrieval for the Field Operations home page.

From these calculations INEEL will provide the following:

- miles per charge per month by: vehicle and model (see Figure SCE-OP 06-5)
- average recharge time by: vehicle and model
- average daily charging load profile by vehicle
- average AC kWh/mile by: vehicle and model

FIGURE SCE-OP 07-1

AVERAGE CHARGE TIME BY VEHICLE MODEL

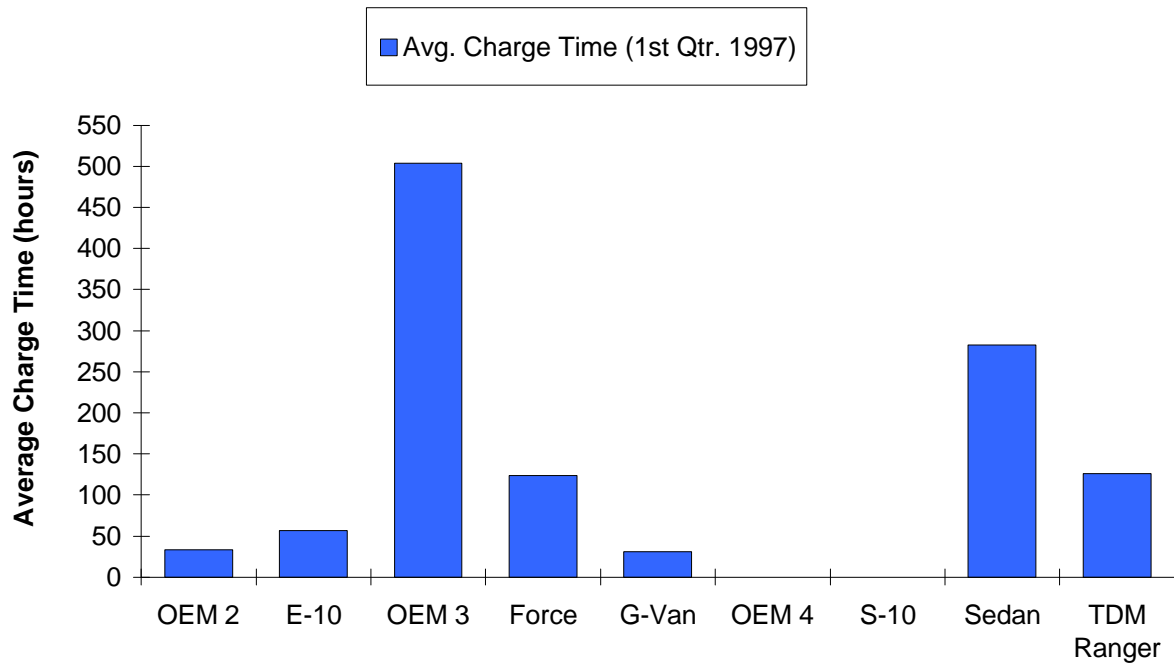
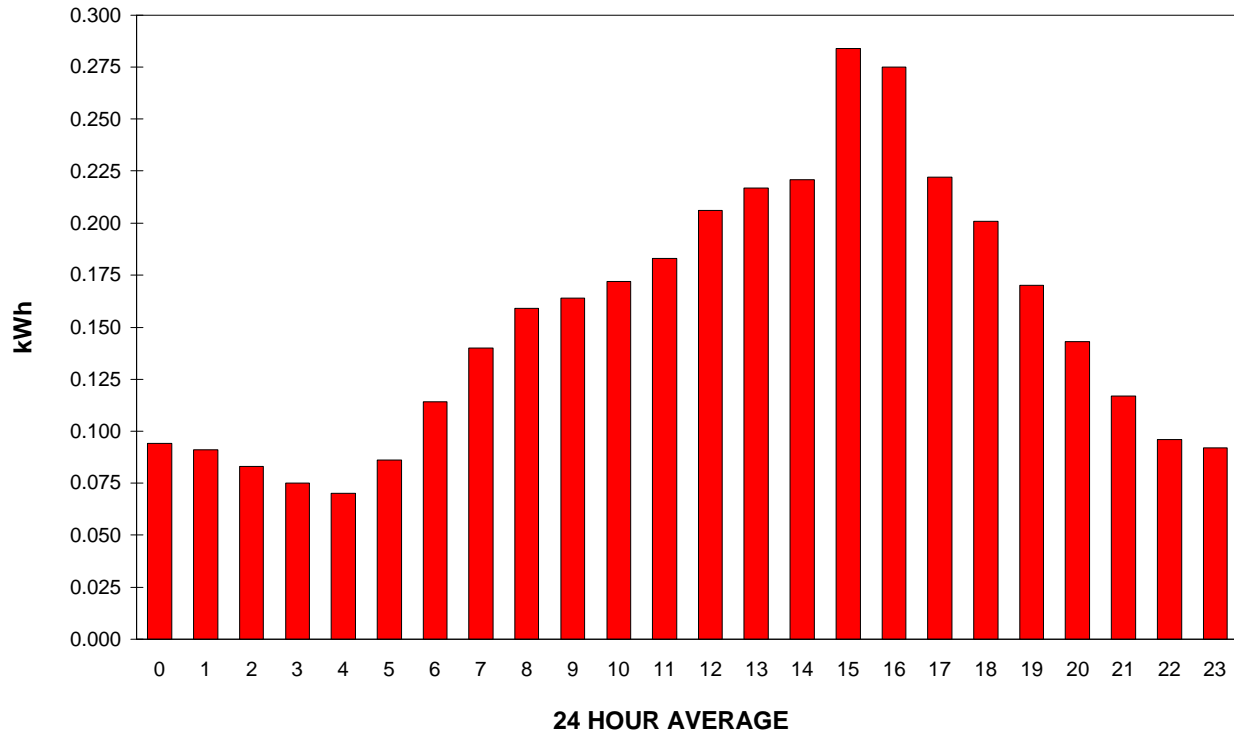


Figure SCE-OP 07-2

AVERAGE CHARGING LOAD PROFILE

CONCEPTOR G-VAN - 4 Qtr 1996

Total quarterly energy = 676.01kWh Max energy used in 15 minute period = .81kWh



Fleet Evaluation Procedure SCE-OP 08

EV Efficiency

1.0 Introduction

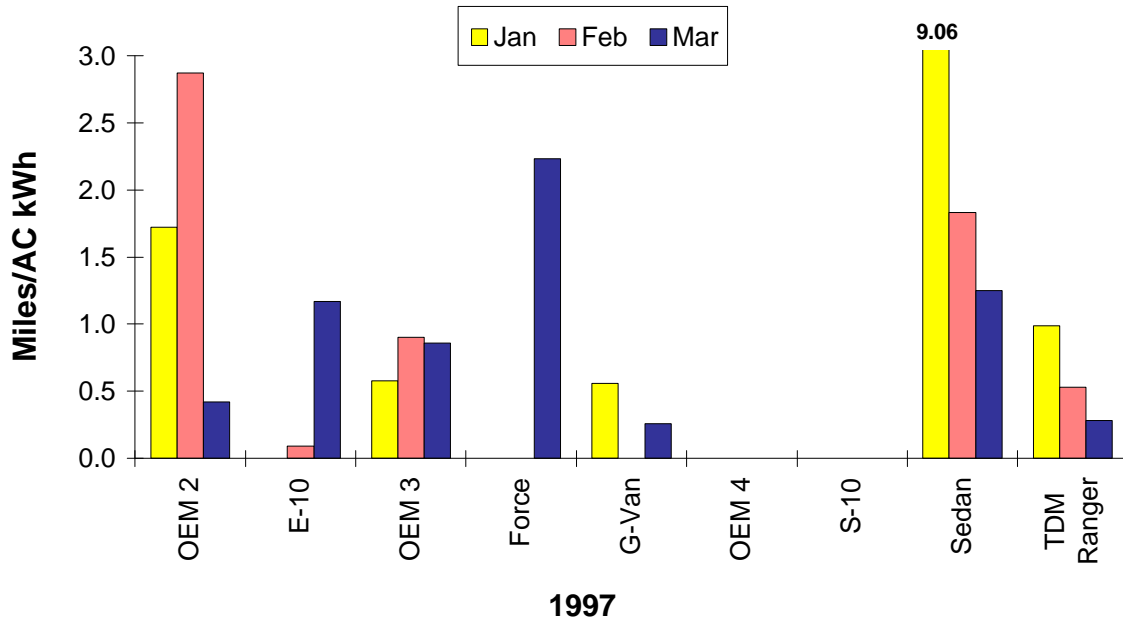
Energy efficiency for an EV (miles/AC kWh) is similar to miles/gallon for an ICE driven vehicle. It can be used to compare different vehicles or to evaluate the effect of different routes, payloads, terrain, charging patterns, and drivers on range.

2.0 Procedure

The mileage and AC kWh were entered in the EV Fleet Database by Procedures SCE-OP 06 and SCE-OP 07. The data shall be extracted for a common time period so the simple division can be accomplished. The resulting quotient shall be displayed per Figure SCE-OP 08-1.

FIGURE SCE-OP 08-1

AVERAGE MILES/AC kWh BY VEHICLE MODEL



Fleet Evaluation Procedure SCE-OP 09

Driver's Response

1.0 Introduction

To have a successful program, it is necessary for the drivers to feel that they are an important part of the program. This can be accomplished by personal and frequent contact, soliciting ideas, implementing their suggestions, and obtaining subjective data via a questionnaire.

2.0 Procedure

On six month intervals or when the EV is reassigned, the driver shall fill in the EV Driver's Questionnaire (Figure SCE-OP 09-1) and return it to the Fleet Manager. The manager shall review the questionnaire and compare it to the previous form (if available). From the review, the manager will be able to determine: the driver's acceptance of the vehicle, how well the vehicle and mission are matched, if any changes should be made to subsequent vehicle specifications, and if there has been a change in the driver's opinion about EVs in the past six months.

A copy of the completed questionnaire shall also be sent to the INEEL at e-mail address pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID 83415-3730. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

Electric Vehicle Driver Questionnaire

Participant _____

DRIVER NAME: _____

DATE: _____

JOB APPLICATION: _____

LOCATION: _____

VEHICLE #: _____

VEHICLE MAKE & MODEL: _____

DRIVEABILITY

SA A NS D SD NA

- | | | | | | |
|--|-------|-------|-------|-------|-------|
| 1. The vehicle feels stable in wet weather conditions
_____ | _____ | _____ | _____ | _____ | _____ |
| 2. The vehicle feels stable highway speeds
_____ | _____ | _____ | _____ | _____ | _____ |
| 3. The vehicle steering is responsive on the road
_____ | _____ | _____ | _____ | _____ | _____ |
| 4. The vehicle acceleration is adequate
_____ | _____ | _____ | _____ | _____ | _____ |
| 5. The vehicle braking is responsive
_____ | _____ | _____ | _____ | _____ | _____ |

CONTROLS AND GAUGES

- | | | | | | |
|--|-------|-------|-------|-------|-------|
| 1. The temperature controls are easy to operate
_____ | _____ | _____ | _____ | _____ | _____ |
| 2. The "state-of-charge" gauge was helpful
_____ | _____ | _____ | _____ | _____ | _____ |
| 3. The "range remaining" gauge was helpful
_____ | _____ | _____ | _____ | _____ | _____ |

INTERIOR

- | | | | | | |
|---|-------|-------|-------|-------|-------|
| 1. The heater provides adequate heat
_____ | _____ | _____ | _____ | _____ | _____ |
| 2. The air conditioner provides adequate cooling
_____ | _____ | _____ | _____ | _____ | _____ |
| 3. The vehicle is free from tire/road noise
_____ | _____ | _____ | _____ | _____ | _____ |
| 4. The interior is free from excessive accessory noise
_____ | _____ | _____ | _____ | _____ | _____ |

CHARGING

- | | | | | | |
|--|-------|-------|-------|-------|-------|
| 1. The refueling (charge) process is simple
_____ | _____ | _____ | _____ | _____ | _____ |
| 2. The vehicle charges adequately (full in the morning)
_____ | _____ | _____ | _____ | _____ | _____ |

GENERAL

- | | | | | | |
|--|-------|-------|-------|-------|-------|
| 1. The vehicle is suited for your job application
_____ | _____ | _____ | _____ | _____ | _____ |
|--|-------|-------|-------|-------|-------|

- | | | | | | |
|---|------------------|------------------|--------|--------------|-------|
| 2. The vehicle has adequate payload | _____ | _____ | _____ | _____ | _____ |
| _____ | | | | | |
| 3. The vehicle has adequate range | _____ | _____ | _____ | _____ | _____ |
| _____ | | | | | |
| 4. The vehicle operates easily (similar to gasoline vehicle) | _____ | _____ | _____ | _____ | _____ |
| _____ | | | | | |
| 5. The vehicle meets your expectation | _____ | _____ | _____ | _____ | _____ |
| _____ | | | | | |
| 6. Overall satisfaction with vehicle | _____ | _____ | _____ | _____ | _____ |
| _____ | | | | | |
| 7. If you had to choose between this vehicle or a similar gasoline vehicle, which would you select? | | | | | |
| | Electric Vehicle | Gasoline Vehicle | Either | (Circle One) | |

COMMENTS

What did you like best? _____

What did you like least? _____

SA: Strongly Agree; **A:** Agree; **NS:** Not Sure; **D:** Disagree; **SD:** Strongly Disagree; **NA:** Not Applicable

Fleet Evaluation Procedures SCE-MA 01

Technician Training

1.0 Introduction

The most important subject in the maintenance technician's training is SAFETY. Most EVs have system voltages that are lethal and some batteries contain hazardous materials. The drive train components are completely different than those found in an ICE vehicle, therefore, different expertise is required to effectively maintain the EV.

2.0 Procedure

All personnel that will perform "under hood" maintenance must attend an EV class in electrical safety, battery safety and maintenance of the specific vehicle(s) in their fleet. If the battery and EV manufacturers conduct training classes, the maintenance technicians should be scheduled to attend.

If it is not practical to send the maintenance personnel to the manufacturer's classes and the in-house expertise exists, then an in-house training program shall be prepared. Appendix E1 in the Fleet Evaluation Guide is an outline of the three-day comprehensive training program that was prepared by SCE and given to their maintenance personnel. As indicated in Appendix A1, page 4, there are two levels of repairs - minor, which are done at the maintenance facility, and major, which are done at the Test and Maintenance Facility (see Procedure SCE-MA 02).

3.0 Documentation

The participant shall document and maintain an up-to-date list of all EV training that each technician received. As verification of the training, the

technician shall receive a certificate or wallet size card that contains the technician's name, name (e.g., type of vehicle, type of battery, etc.) and date of the training, and the instructor's signature.

Fleet Evaluation Procedure SCE-MA 02

New Maintenance Equipment Needed

1.0 Introduction

The EVs will require maintenance and repair so the participant must decide between the following three options on how that will be accomplished:

- **EV Test and Maintenance Facility** - This is the most comprehensive facility so maintenance and major repairs can be undertaken.
- **EV Preventive Maintenance Facility** - This facility is designed to perform preventative maintenance and minor repairs only. Major repairs will have to be accomplished by another organization.
- **Service Contract** - The service contract can be written to provide major repairs only (in support of the maintenance facility) or for all repairs plus maintenance. It is essential that the service organization have experience in EVs and sufficient parts inventory to minimize the out-of-service time.

The new equipment needed will depend on which of the above options are selected.

2.0 Procedure

Depending on the size of the EV fleet and the company's strategies, one or more of the above options shall be selected. Table SCE-MA 02-1 delineates the major types of equipment recommended at the participants EV facility for the above three options. The participant must indicate which option was selected and document how the needs for maintenance equipment were met.

It is mandatory for all participants to have a system that will collect and manipulate maintenance, accounting and other data from various sources. A general description of the data acquisition system and supporting forms can be found in Paragraphs 4.2.1 and 4.2.2 in the Fleet Evaluation Guide. The data collection may be manual (i.e. vehicle mileage) or automated (i.e. ABB meter). The data must be entered into the EV Fleet Database so it can be utilized to generate the mandatory Quarterly Report Charts and Tables (Appendix G1 in the Fleet Evaluation Guide).

MAJOR EQUIPMENT REQUIRED FOR EV MAINTENANCE AND REPAIR

	EV Test and Maintenance Facility	EV Maintenance Facility	Subcontract
Participants			
1. Programmable battery pack tester	X		
2. Load Banks	X		
3. Battery chargers for modules	X		
4. Battery removal and handling equipment	X		
5. Vehicle hoist	X	X	
6. Digital multimeters	X	X	X
7. Recording power and energy meter	X	X	
8. Silent Witness (or equivalent)	X	X	
9. Computers for downloading data	X	X	
10. Fluke Scopemeter (or equivalent)	X	X	
11. Power quality analyzer	X		
12. Data acquisition system	X	X	X
13. EV Fleet Database	X	X	X

Fleet Evaluation Procedure SCE-MA 03

New Maintenance Facilities Needed

1.0 Introduction

The new facilities requirements will be affected by which of the following options the participant selects:

1. EV Test and Maintenance Facility
2. EV Preventative Maintenance Facility
3. Service Contract

2.0 Procedure

The participant must select the options which are appropriate for the EV fleet size and that fulfill the company's guidelines. The following are brief descriptions of the facilities' impact for the options:

- The EV Test and Maintenance Facility will require the following areas dedicated to EVs: a service bay with a two-post lift, a service bay without a lift, and an area about the size of a service bay for battery testing, an equipment storage area, plus office space for test and maintenance personnel. The approximate area of this facility is 3500 square feet. Adequate electrical power must be installed to accommodate high rate chargers and the battery pack test equipment. Also, the chargers and kWh meters must be installed and operational before the EVs are received.
- The Preventative Maintenance Facility will not increase the size of the facility if it is assumed the EVs will replace the ICE vehicles. A small storage cabinet may be required for the electrical/electronic equipment.

- A Service Contract for EV maintenance and repair will not increase the participants facilities requirements.

Fleet Evaluation Procedure SCE-MA 04

Parts Inventory

1.0 Introduction

The participants parts inventory will be affected by which one of the following options is selected for EV test and maintenance:

1. EV Test and Maintenance Facility
2. EV Preventative Maintenance Facility
3. Service Contract

2.0 Procedure

The participant shall document which of the above options was selected and provide a description of the parts, costs and quantities from the following general descriptions:

- The EV Test and Maintenance Facility - Only those items that are unique, long lead time (2 days or longer), and frequently replaced shall be stocked. Sources of item descriptions are the manufacturer or dealer, other organizations with similar vehicles, and the Fleet Management System if similar vehicles are in the participant's fleet. If replacement modules are not readily available and the battery packs are at least two years old, modules shall be stocked so failed or weak modules can be quickly replaced and the vehicle returned to service.
- EV Preventative Maintenance Facility - Only those items that are unique, long lead time (2 days or longer), and frequently replaced during routine maintenance should be stocked. The manufacturer or dealer will be able to make recommendations on the parts to stock.

- Service Contract - The participant will not have to stock replacement parts. The contractor shall be responsible for the parts inventory.

Fleet Evaluation Procedure SCE-MA 05

Maintenance Labor (Hrs.)

1.0 Introduction

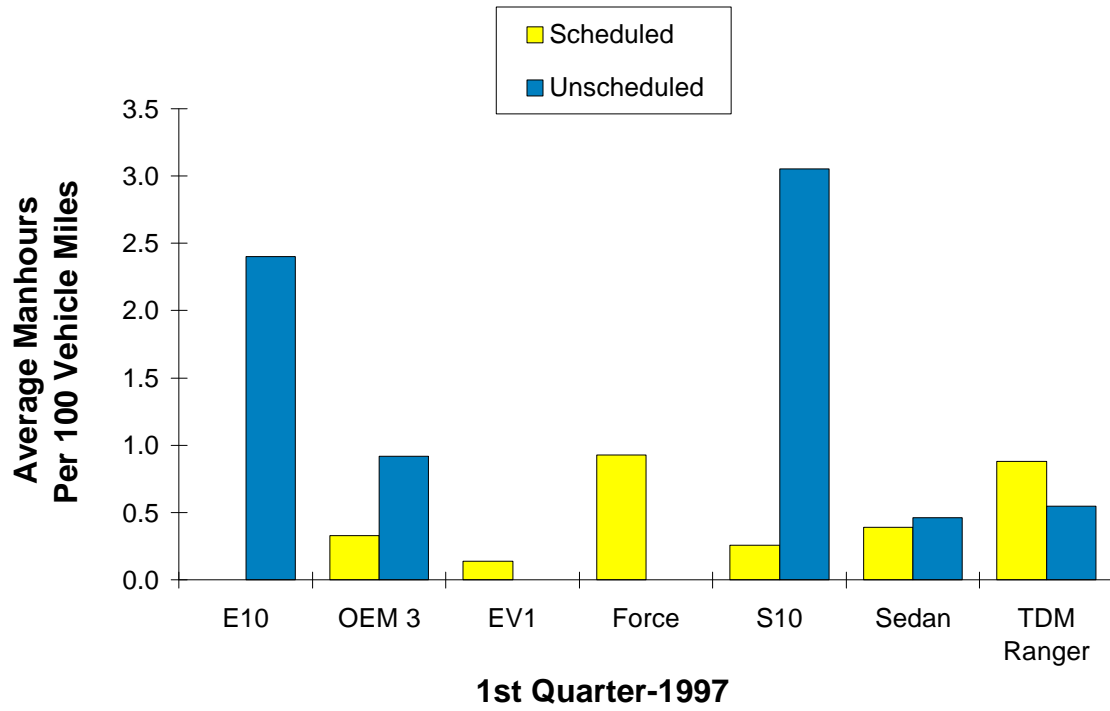
In order to compare the maintenance experience with various types of EVs or to compare them to similar ICE powered vehicles, the maintenance labor hours must be recorded for each vehicle. Also, the labor hours along with labor rates, are required to calculate the maintenance costs.

2.0 Procedure

The participant shall have a data acquisition system that will accurately collect the preventive (scheduled) and unscheduled maintenance hours for each vehicle. The EV Fleet Database shall accumulate the hours and display them in the format indicated by Figure SCE-MA 05.

FIGURE SCE-MA 05-1

SERVICING MANHOURS BY VEHICLE MODEL



Fleet Evaluation Procedure SCE-MA 06

Vehicle Availability/Downtime

1.0 Introduction

It is very important for a fleet operator to monitor vehicle availability for service. When a vehicle is unavailable, a replacement must be found to complete the mission. This increases costs because two vehicles are being allocated to complete one mission. Vehicle downtime creates scheduling challenges for the dispatcher which also increases cost.

2.0 Procedure

The Vehicle Repair Order (Figure SCE - MA 06-1) or similar form shall be used to: start the “out-of-service clock” in the EV Fleet Database, record the arrival of the repair parts, and indicate the completion of the repair (return to service). This data shall be displayed in the format indicated by Figures SCE-MA 06-2 and 3.

A vehicle shall be considered “Out of Service” if it cannot reliably accomplish the assigned mission. This could be the result of a failed component or battery degradation caused by use and/or age. The vehicle with a low capacity battery could be reassigned to a less demanding roll without any repairs. However, all of the time the EV is waiting to be reassigned shall be considered “Out of Service.”

If an EV is being repaired under warranty or by a service contract, the “waiting time for parts” and the number of hours for the repair may not be available, so that should be noted on the Vehicle Repair Order. However, the component code for the failed component (see Figure SCE-MA 08-2) must be on the Vehicle Repair Order because that information is required for Procedures SCE-MA 07 and SCE-MA 08.

3.0 Data Collection

A copy of the completed Vehicle Repair Order shall be sent to the INEEL at e-mail address pvm@inel.gov or mailed to Patti McGuire, PO Box 1625, Idaho Falls, ID 83415-3730. All questions can be directed to Patti McGuire at 208-526-0890 or James Francfort at 208-526-6787.

Participant _____

		0					
MAKE	TYPE	VEHICLE NO.					
DESCRIBE TROUBLE IN DETAIL (driver/operator):							
DRIVER		DIST. OR DEPT.			DATE		

[illegible]

COPY DISTRIBUTION: White - Place in Vehicle Folder
Canary - Forward to Dist. or Dept. Manager
Pink - Place in Vehicle after Repairs are Completed
Goldenrod - Operator's Supervisor

FIGURE SCE-MA 06-1

UNAVAILABLE FOR SERVICE (DOWNTIME) BY VEHICLE MODEL

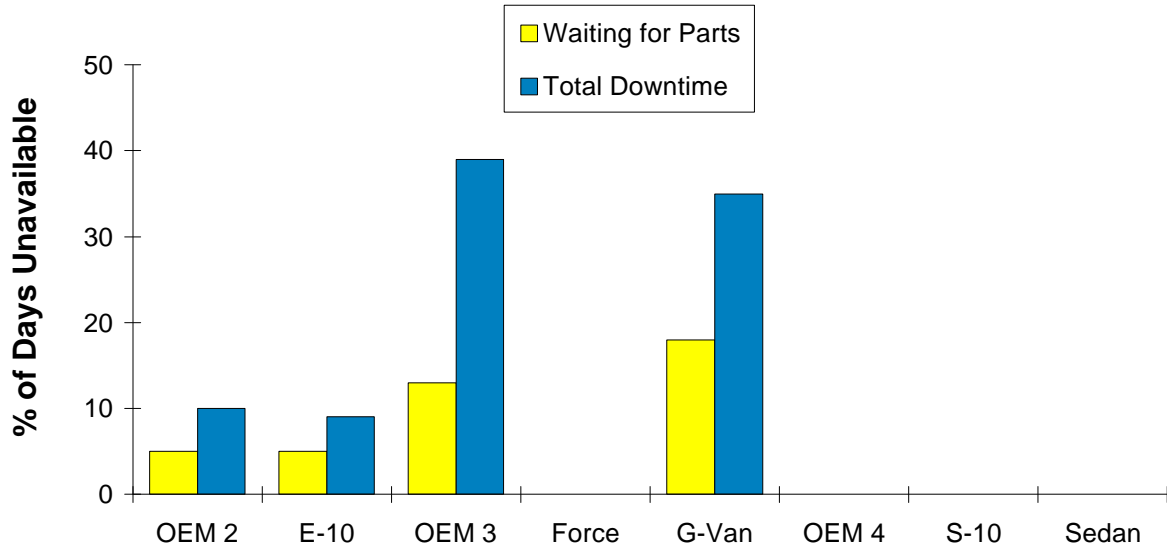
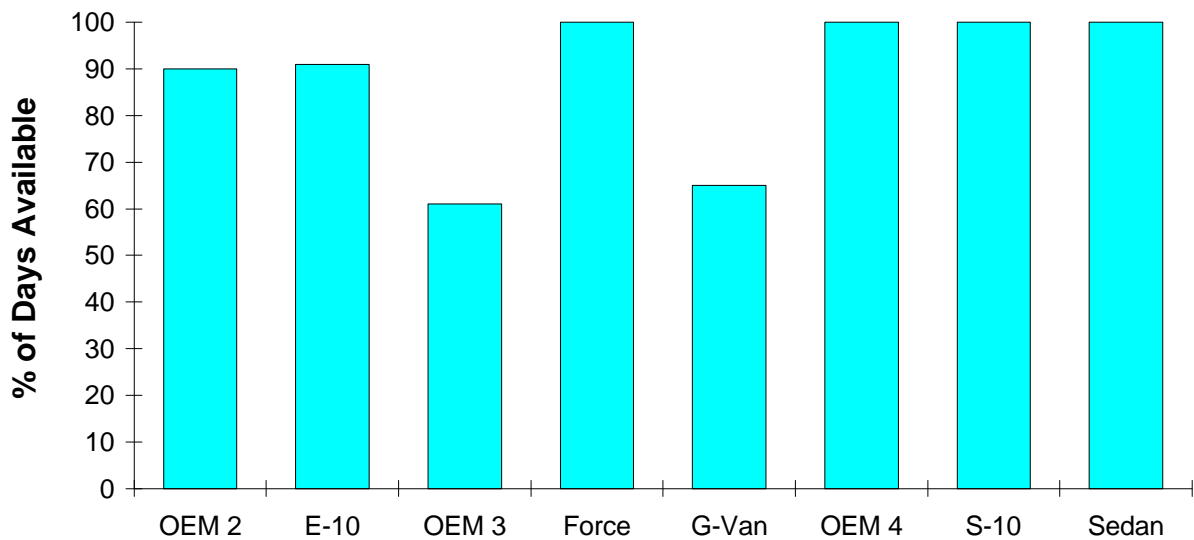


FIGURE SCE-MA 06-3

AVAILABLE FOR SERVICE BY VEHICLE MODEL



FOR ILLUSTRATION ONLY

Fleet Evaluation Procedure SCE-MA 07

Quit-On-Road Incidents

1.0 Introduction

If an EV quits on the road it is expensive because: the mission is not completed, the operator becomes non-productive, another vehicle plus driver must be dispatched to retrieve the EV driver and the EV, and a replacement vehicle will be required to complete the mission.

2.0 Procedure

A quit-on-road incident is the inability of the EV to complete the assigned mission and return to the base of operation.

The Vehicle Repair Order (Figure SCE-MA 06-1) or similar form shall be used to provide a record of a quit-on-road incident and the system/subsystem responsible. It will also provide the input to the EV Fleet Database where the data can be accumulated. The data shall be displayed in the format indicated by Figures SCE-MA 07-1A and 1B. The quit-on-road figures indicate why the EV did not complete the assigned mission. The data presented is a subset of the system reliability which is addressed in procedure SCE-MA 08.

FIGURE SCE - MA 07-1A

G-VAN QUIT-ON-ROAD INCIDENTS

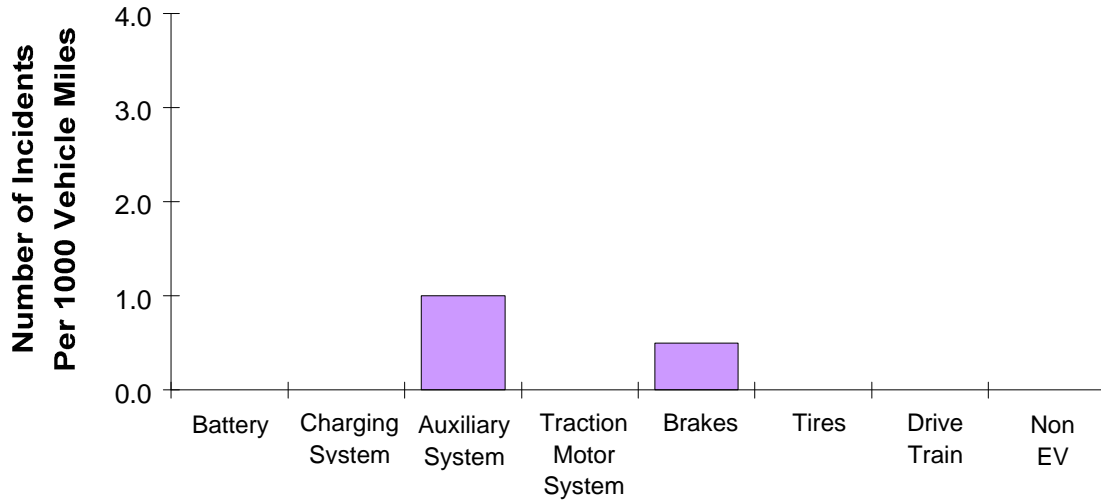
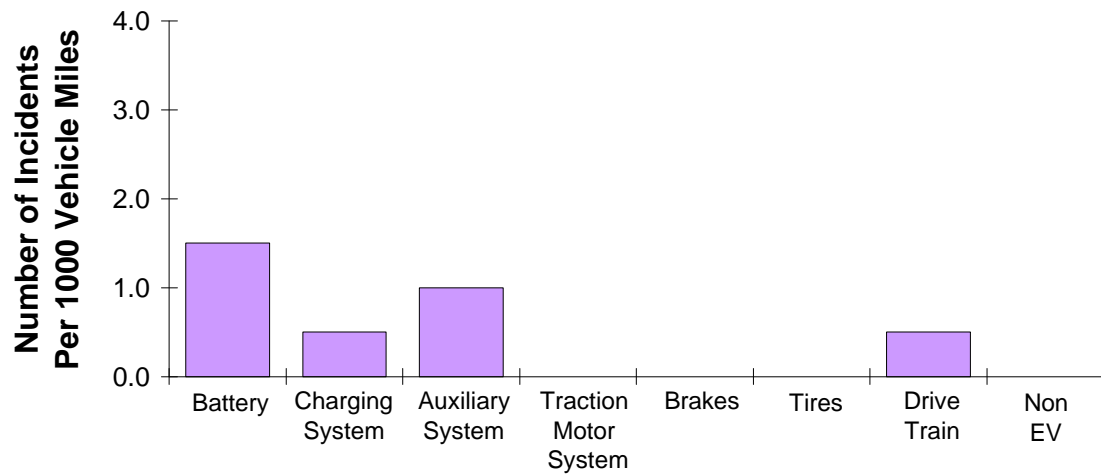


FIGURE SCE - MA 07-1B

OEM 3 QUIT-ON-ROAD INCIDENTS



FOR ILLUSTRATION ONLY

Fleet Evaluation Procedure SCE-MA 08

Vehicle System Reliability

1.0 Introduction

Tracking EV systems reliability in a fleet operation can be valuable to the vehicle manufacturer for correcting field failures and making design improvements, and to other fleet operators so they know what to expect and can stock the appropriate repair parts for their EVs.

2.0 Procedure

The Vehicle Repair Order (Figure SCE -MA 06-1) or similar form shall be used to document and identify the major EV system failure. It will also be used to provide data for EV Fleet Database which will store and manipulate the data, and display the data in the format indicated by Figures SCE-MA 08-1A and 1B.

A list of the major subsystems that comprise each system can be found in Figure SCE-MA 08-2.

FIGURE SCE - MA 08-1A

G-VAN SYSTEM RELIABILITY

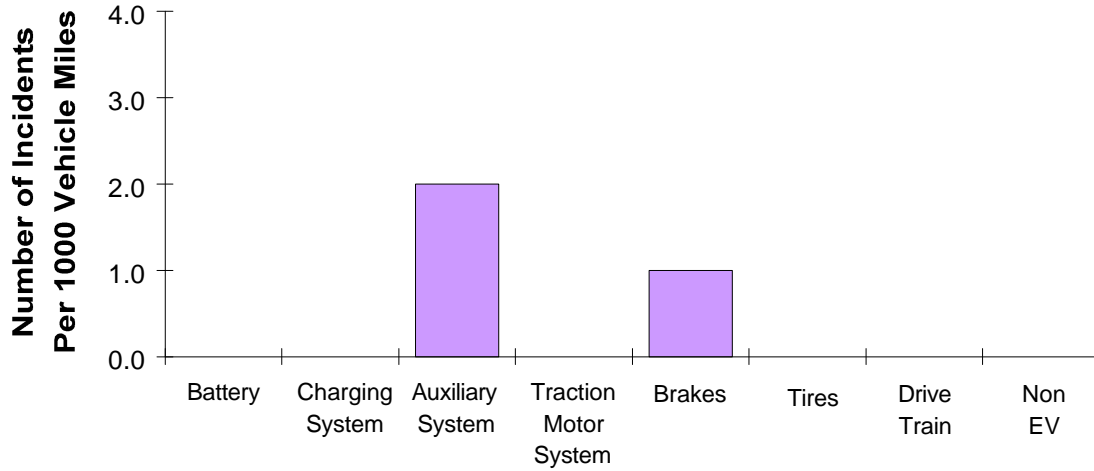
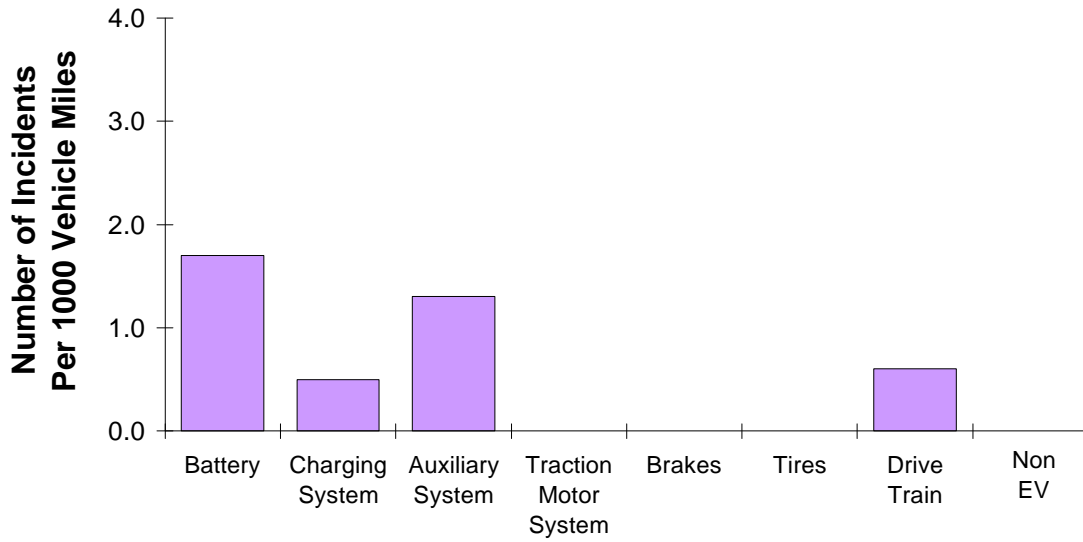


FIGURE SCE - MA 08-1B

OEM 3 SYSTEM RELIABILITY



FOR ILLUSTRATION ONLY

Figure SCE-MA 08-2

Electric Vehicle Field Evaluation Procedure DOE Field Operations Program Southern California Edison Co.

ELECTRIC VEHICLE RELIABILITY Systems/Subsystems Breakdown

	Part ID
I. BATTERY SYSTEMS	0100
TRACTION BATTERY	0101
BATTERY MODULE	0102
BATTERY TRAY	0103
BATTERY WIRING HIGH VOLT	0104
BATTERY FAN	0105
BATTERY FAN FILTER	0106
BATTERY HEATER	0107
BATTERY DISCONNECT	0108
BATTERY FUSE	0109
BATTERY MANAGEMENT SYSTEM	0110
BATTERY CURRENT SENSOR	0111
BATTERY TEMP. SENSOR	0112
STATE OF CHARGE GAGE	0113
II. CHARGING SYSTEM	0200
ONBOARD CHARGER	0201
ONBOARD CHARGING PORT	0202
ONBOARD CHARGING WIRING	0203
CHARGER FAN	0204
CHARGER FUSE	0205
CHARGING ALGORITHM CARD	0206
III. TRACTION MOTOR SYSTEM	0300
TRACTION MOTOR	0301
MOTOR FAN	0302
MOTOR FILTER	0303
MOTOR MOUNT	0304
MOTOR SEAL	0305
MOTOR HOSE	0306
THROTTLE SYSTEM	0307
CONTROLLER / PCU	0308
CONTROLLER FAN	0309
CONTROLLER FILTER	0310
CONTROLLER CABLE	0311
CONTROLLER WIRING HARNESS	0312
CONTROLLER CONNECTORS	0313
TRACTION SYSTEM COOLING	0314

Figure SCE-MA 08-2

**Electric Vehicle Field Evaluation Procedure
DOE Field Operations Program
Southern California Edison Co.**

**ELECTRIC VEHICLE RELIABILITY
Systems/Subsystems Breakdown**

	Part ID
IV. DRIVE TRAIN	0400
AXLE	0401
CV JOINT	0402
DIFFERENTIAL / REAR AXLE	0403
REAR AXLE SEAL	0404
DIFFERENTIAL MOUNT	0405
PARKING PAWL	0406
TRANSMISSION / TRANSAXLE	0407
TRANSMISSION / TRANSAXLE SEAL	0408
TRANSMISSION / TRANSAXLE MOUNT	0409
TRANSMISSION / TRANSAXLE SHIFTER	0410
V. AUXILIARY SYSTEMS	0500
DC/DC CONVERTER	0501
AUXILIARY BATTERY	0502
AUXILIARY BATTERY FUSE	0503
BACKUP ALARM	0504
MISC. BELT	0505
HEATING SYSTEM (RESISTANCE OR FUEL FIRED)	0506
OTHER GAGE	0507
POWER STEERING MOTOR	0508
POWER STEERING MODULE	0509
POWER STEERING CONTROLLER	0510
RELAY	0511
WARNING LIGHT	0512
MISC. HOSE	0513
COOLING SYSTEM	0514
A/C COMPRESSOR	0515
A/C HOSE	0516
A/C VALVE	0517
HEAT PUMP REVERSING VALVE	0518
A/C MOTOR CONTROLLER	0519
GROUND FAULT	0520
VI. BRAKES	0600
BRAKE CONTROLLER	0601
POWER BRAKE MODULE	0602
BRAKE PADS	0603
BRAKE ROTOR	0604
BRAKE DRUM	0605
REGENERATIVE MODULE	0606

Figure SCE-MA 08-2

Electric Vehicle Field Evaluation Procedure
DOE Field Operations Program
Southern California Edison Co.

ELECTRIC VEHICLE RELIABILITY Systems/Subsystems Breakdown

	Part ID
VII. TIRES/WHEELS	0700
TIRE	0701
WHEEL	0702
VIII. NON EV RELATED	0800

Fleet Evaluation Procedure SCE-MA 09

Operating Costs

1.0 Introduction

The operating costs are the variable costs that are generally dependent on vehicle mileage. The most significant variable cost items that will be presented in the following paragraphs are: Energy, Maintenance, Component Replacements, and Battery Amortization. All of these costs shall be calculated on a per mile basis so they can be summed and the total cost per mile presented.

2.0 Procedure

The following are the procedures for calculating the above costs:

2.1 Energy

The energy usage and miles traveled are resident in the EV Fleet Database, so the kWh per mile shall be calculated and then multiplied by the cost per kWh to obtain the cost per mile. If time-of-use (TOU) metering is being utilized, the billing department shall provide, for use in the EV Fleet Database, an algorithm of energy costs vs. time so the total energy cost can be calculated.

2.2 Maintenance

The preventive (scheduled) and unscheduled servicing man-hours per mile are being collected in the EV Fleet Database via the Vehicle Repair Order (see SCE-MA 06-1). These numbers shall be added together and multiplied by the average burdened labor rate (overhead plus, general and administrative) to obtain the total maintenance cost per vehicle mile traveled.

2.3 Component Replacement

The replacement parts cost per vehicle mile are being accumulated in the EV Fleet Database via the Vehicle Repair Order (see SCE-MA 06-1). To obtain an accurate cost picture, these costs shall also contain the appropriate material burden (overhead to obtain the part).

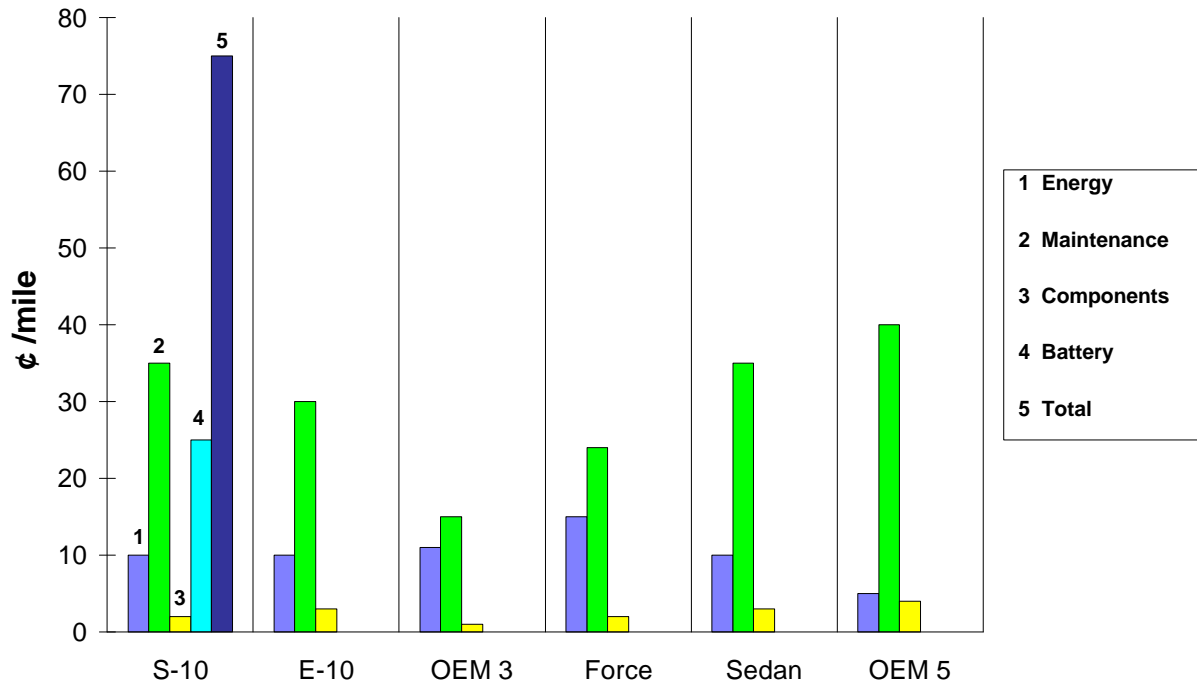
2.4 Battery Amortization

The traction batteries are being consumed by use. Therefore, this operating cost shall be identified and quantified in order to compare the total operating cost of one EV to another, and to conventional vehicles. If the batteries have been replaced, the battery replacement cost shall be divided by the miles traveled, to yield the dollars per mile. However, if the vehicle is relatively new and the batteries have not been replaced, one of the scenarios described in Fleet Evaluation Guide, Paragraph 8.4, must be used to obtain the cost per mile.

Since battery amortization is in the same units as the energy, maintenance, and component replacement costs, discussed in previous paragraphs, all of these costs can be added together to obtain total operating cost per mile. All of the costs shall be displayed in the format indicated by Figure SCE-MA 09-1.

FIGURE SCE - MA 09-1

AVERAGE EV OPERATING COSTS BY MAJOR CATEGORY



FOR ILLUSTRATION ONLY

Fleet Evaluation Procedure SCE-OW 01

Vehicle Acquisition

1.0 Introduction

The two methods used to acquire fleet vehicles are lease and purchase. Leased vehicles are “paid-off” before the end of the vehicle’s life and purchased vehicles are, usually, completely depreciated before the vehicle’s end of life.

2.0 Procedure

The Accounting Department shall provide the input algorithms for the EV Fleet Database so that the lease costs or depreciation and interest costs for a purchased vehicle can be calculated on a monthly basis and spread over the expected life of the vehicle.

Incentives to purchase EVs such as income tax credits, income tax deductions, demonstration project revenues, research and development cost share, source emission credits and vehicle trip emission credits shall be quantified and the value of the credit subtracted from the cost of the vehicle. The Accounting Department shall quantify the credits and provide the data for entry into EV Fleet Database.

The cumulative costs for a specified time frame shall be divided by the total vehicle mileage, for the same time frame, to yield the acquisition cost per mile of travel. Because the vehicle mileage could vary significantly from month to month and the costs are relatively constant, the cost per mile (on a monthly

basis) will undergo large fluctuations. As the cumulative costs and mileage increase, the fluctuations will diminish.

Fleet Evaluation Procedure SCE-OW 02

Vehicle License/Insurance

1.0 Introduction

In some states, the vehicle license fees vary as a function of age or depreciated value. The formulas are published so the fees can be calculated by anyone.

Many large companies are self-insured so the exact cost of vehicle insurance (liability, collision, comprehensive and medical) may not be known on a per vehicle basis.

2.0 Procedure

The yearly license fee or the formula for calculating the fee shall be input into the EV Fleet Database. The fees shall be calculated on a monthly basis, and the cumulative fees divided by the total mileage, for the same time period, to yield the cost per mile of travel for the period.

If EV insurance is procured, the cost shall be input into the EV Fleet Database. If the company is self-insured, then the accounting department shall provide the cost of insurance for each vehicle, for input into the EV Fleet Database. If the insurance costs are not segregated by vehicle, then an appropriate share of the costs shall be allocated to each EV, by the Accounting Department. After the insurance costs are known, they shall be calculated on a cost per mile of travel basis using the procedure described above.

Fleet Evaluation Procedure SCE-OW 03

Safety Training

1.0 Introduction

There are some characteristics of EVs which are significantly different than ICE driven vehicles. Both the drivers and maintenance personnel must be made aware of the differences so they will avoid the potential hazards.

2.0 Procedure

All participants shall provide and document the operational safety training the drivers and maintenance personnel have received, and describe how the training was tailored to the needs of these two groups. For both the drivers and maintenance personnel, the documentation shall include, at a minimum, the following:

- Location of instruction
- Lesson plans (see Appendix E1 in the Fleet Evaluation Guide)
- List of students in class
- Instructor's name(s)
- Student tests
- Student questionnaire/evaluation
- Hours of instruction

The training may be conducted by representatives of the vehicle manufacturer, the battery manufacturer, the fleet manager's office (if the expertise exists), or combinations of those listed.

Fleet Evaluation Procedure SCE-OW 04

Emergency Preparedness

1.0 Introduction

Electric Vehicles are significantly different than ICE driven vehicles. Each has a unique set of hazards, and those hazards must be known by the emergency response personnel. In addition, EVs contain different types of batteries and each type has unique hazards. The hazards associated with batteries could be: acid, caustic, explosive gas, nauseous gas, materials that react with water, high temperature and, with all batteries, high voltage. This is why it is so important for the emergency response personnel to know what type of battery is in each EV.

2.0 Procedure

All participants shall provide emergency response training for all of the company personnel, that could be involved in emergency activities. Some maintenance personnel are the most likely to be involved in electric vehicle emergencies. The training shall be documented, and at a minimum, the documentation shall include the following:

- Location of Instruction
- Lesson plans
- List of students in class
- Instructor's name(s)
- Student tests

- Student questionnaire/evaluation
- Hours of instruction

Local fire and police departments shall be notified when an EV is assigned to their area. They shall be informed of the type of batteries in the EV, so the proper response will be initiated. An excellent Instructor's Guide, which was prepared by the California Department of Forestry and Fire Protection, can be found in the Fleet Evaluation Guide, Appendix E2.

Fleet Evaluation Procedure SCE-OW 05

Battery Decommissioning

1.0 Introduction

A battery pack is the most likely component to be removed from an EV prior to salvage. The removed pack shall be evaluated so its value can be determined.

2.0 Procedure

The cost of removing the pack for test and testing the pack shall be charged to the vehicle because the data is useful in predicting battery life. The cost of removing the pack for use in another application shall be prorated to each module. The depreciated value of the pack/modules shall be credited to the vehicle from which it was removed. Note: the serviceable modules should be identified so the donating vehicle records (see SCE-OW 06-1) can be entered to determine the module value.

A vehicle receiving a salvaged module shall be charged the depreciated value of the module plus the prorated cost of removal.

The cost or money received for disposal of individual modules shall be applied to the vehicle from which they were removed.

Fleet Evaluation Procedure SCE-OW 06

Vehicle Decommissioning

1.0 Introduction

An EV may be reassigned to another role/site, given to an institution (e.g. college, high school, etc.) or sold. If vehicle is to be sold, some preparations may be appropriate, e.g. removal of special equipment, cosmetic work, or maintenance to improve the vehicle's appeal to potential buyers.

2.0 Procedure

Figure SCE-OW 06-1, or a similar form, shall be used to assess the condition of the EV and assist in making a decision on reassigning the vehicle to another role/site or disposing of the vehicle.

The following accounting guidelines shall be followed:

- Removal of special test equipment shall not be charged to the vehicle because it is not part of the normal ownership costs.
- Any costs which increase the vehicle's value shall be charged to the vehicle.
- If a component is removed from the vehicle for use on another vehicle, the donating vehicle shall be given a credit equal to the depreciated value of the of the component.

- The receiving vehicle shall be charged for the time to remove the part from the donated vehicle, the depreciated value of the part, and the installation time.

Only after all of the costs and credits have been posted to the decommissioned vehicle, and the vehicle disposed of, can the actual cost of ownership be calculated.

RECORD # 1		EQUIPMENT & MATERIAL TRACKING LOG									
DATE RECEIVED		PARTICIPANT:					BUDGET CODE				
RECVD BY	VEH #	VEHICLE DESCRIPTION			VEHICLE MODEL		VEHICLE TYPE				
SERIAL NUMBER (17 DIGITS)	MILEAGE	EXCEEDS LIMITS	LICENSE NUMBER	PFR (Y/N)	LIC EX MM/YY	VEH YR	SCE MAN (Y/N)	RECORDS RECEIVED (Y/N)	SMOG (Y/N)	EV	
RECEIVED FROM	MONTHLY AMORTIZED	TOTAL AMORTIZED	ESTABLISHED VALUE	BLUEBOOK VALUE	4X4 (Y/N)	A/T (Y/N)	A/C (Y/N)	NO.CYL (4,6,8)			
HI MILEAGE (Y/N)	EXTENSIVE REPAIRS (Y/N)	RUST ON BODY (Y/N)	WORNOUT (Y/N)	BAD ENGINE (Y/N)	BAD TRANS (Y/N)	VEHICLE CONDITION					
BAD PAINT (Y/N)	BAD INTERIOR (Y/N)	NOT NEEDED (Y/N)	WRECK (Y/N)	GENERAL INFORMATION							
EV BATTERY PACK											
SALVAGE PACK (Y/N)	PACK COST \$	MODULE COST \$	DEPRECIATED MODULE \$	MODULE REMOVAL \$	MODULE VALUE \$						
				+		=					
EQUIPMENT HOLD/RETURN INFORMATION											
RETURN TO SERVICE (Y)	GARAGE LOCATION	RETURN DATE	DONATION CANDIDATE?	HOLD/RELEASE INFO.							
HOLD (Y)	HOLD REQUESTER	HOLD START DATE	REFURBISH CANDIDATE?								
EQUIPMENT SALE INFORMATION											
BID LINE OPEN	BID LINE CLOSE	ACTIVE BID INFORMATION									
SALE LINE NUMBER	ITEM NUMBER	SOLD (Y/N)	SUCCESSFUL BIDDER	BID PRICE	PICKED UP (Y)	RELEASE DATE					
EQUIPMENT REBID INFORMATION											
REBID LINE NUMBER	ITEM NUMBER	BID PRICE									
REBID 1											
REBID 2											
REBID 3											
REBID 4											
REBID 5											

BLUEBOOK 10100

Fleet Evaluation Procedure SCE-OW 07

Ownership Costs

1.0 Introduction

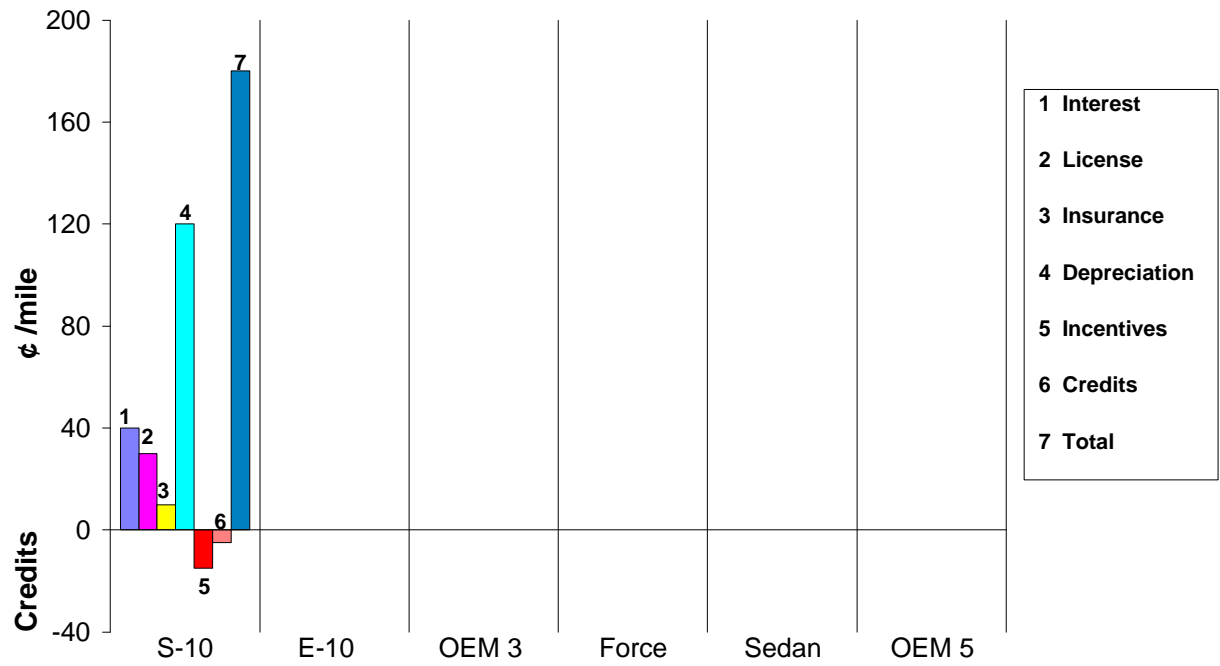
The ownership costs are the costs of owning the vehicle even if it isn't driven. So, greater vehicle utilization will not significantly affect these costs, however, it will reduce the cost per mile. The ownership costs are not "fixed costs" because some are affected by the age of the vehicle (e.g., depreciation, license, insurance, etc.). As discussed in Ownership Procedures SCE-OW 01, OW 02, OW 05 and OW 06, the total cost of ownership can only be computed if algorithms are prepared for those cost items that are affected by the age of the vehicle.

2.0 Procedure

All of the ownership costs must be converted to a common basis (. per mile) so they can be summed. The ownership costs shall be presented, by vehicle, in the format indicated by Figure SCE-OW 07-1.

Figure SCE - OW 07-1

AVERAGE EV OWNERSHIP COSTS BY MAJOR CATEGORY



Fleet Evaluation Procedure SCE-OW 08

Total Costs

1.0 Introduction

The total EV cost is the sum of the operating costs, maintenance costs, and the ownership costs. The total cost has been divided into four of the highest cost groups. They are: energy and battery; maintenance and components; miscellaneous which is comprised of interest, taxes, license, insurance, incentives and credits; and depreciation.

2.0 Procedure

All costs must be converted to a common basis (. per mile) before the costs can be added to one another. The costs shall be combined into the four groups delineated above for each vehicle, and the sums presented monthly, quarterly, and yearly in the format indicated by Figure SCE-OW 08-1.

FIGURE SCE - OW 08-1

TOTAL EV COSTS BY MAJOR CATEGORY

